## CLAIMS

We claim:

1. A method for encoding a 2D symbol, the method comprising:

converting binary data into a first bit-stream of codeword data;

calculating a set of error correction codewords from the first bit-stream based on a predefined error correction level;

combining the first bit-stream and the set of error correction codewords into a second bit-stream of codeword data;

dividing the second bit-stream into a set of equally sized data segments;

adding a set of control information codewords into each of the data segments; and

adding a data segment divider between the data segments;

providing a top border and a bottom border, a left border and a right border circumscribing the data segments such that the 2D symbol is so created.

2. The method as recited in claim 1, further comprising:

re-arranging at least two of the second bit-stream in an interleaved order.

3. The method as recited in claim 1, wherein the second bit-stream is represented in bars and spaces, the method further comprising:

performing a masking operation or bitwise-XOR operation on the second bit-stream with a predefined mask to avoid the bars concentrated in a particular area.

4. The method as recited in claim 1, wherein the top border includes at least one start code pattern and one terminator code pattern, and the bottom border includes at least one end code pattern and one terminator code pattern to facilitate detection of an orientation of the 2D symbol.

5. The method as recited in claim 4, wherein the start code pattern of the top boarder and the end code pattern of the bottom border includes a number of

alternated bars and spaces, the start code pattern as well as the end code pattern has a number of modules in accordance with a predefined width ratio.

6. The method as recited in claim 1, wherein the left border and the right border are a pair of identical positioning blocks including alternating bars and spaces according to a predefined pattern.

7. The method as recited in claim 6, wherein the second bit-stream is represented by bars and spaces in a data element area, each of the bars and spaces in the left or right border corresponding to one or more of bars and spaces in the data element area.

8. The method as recited in claim 6, wherein each of the bars or spaces in the left or right border facilitates determination of vertical print resolution of a scanner used to scan the 2D symbol.

9. The method as recited in claim 6, wherein each of the bars or spaces in the left or right border dictates the vertical print resolution, and each of bars or spaces in the top or bottom border dictates a horizontal print resolution of the 2D symbol to a scanner in order to scan the 2D symbol more efficiently.

10. The method as recited in claim 6, wherein each of the bars or spaces in the left or right border indicates whether a scanned image of the 2D symbol is distorted, and facilitates correction of the scanned image if the scanned image is distorted.

11. The method as recited in claim 1, wherein the second bit-stream is represented in bars and spaces in a data element area, and the method further comprising:

adding a set of equally spaced parallel positioning lines to one side or both sides of the 2D symbol, the positioning lines having a different slope from

a horizontal axis of the 2D symbol to facilitate determinations of an orientation of the 2D symbol as well as the bars and spaces in the data element area.

12. The method as recited in claim 1, further comprising:

superimposing a set of equally spaced parallel positioning lines on the 2D symbol, the positioning lines having a different slope from horizontal axis of the 2D symbol.

13. The method as recited in claim 12, wherein the positioning lines are in a color different from that of the 2D symbol to be readily determined from an scanner image of the 2D symbol by a scanner.

14. The method as recited in claim 1, wherein the set of control information comprises:

total number of the data segments;

an interleaf toggle;

an pre-selected error correction level;

a predefined mask type; and

a data segment number.

15. The method as recited in claim 1, wherein each of the data segments includes codeword that is a matrix of three columns by three rows of bars or/and spaces.

16. A method for decoding a 2D symbol including a plurality of bars and spaces in a data area representing a bit-stream of codeword data from a binary data file, the data area circumscribed by a top border, a bottom border, a left border and a right border, a plurality of data segment dividers dividing the bit-stream data area into a plurality of data segments, the method comprising:

scanning the 2D symbol in entirety to produce a stored image;

searching in the stored image for the top border having a start code pattern and the bottom border having an end code pattern ;

determining a horizontal axis and a vertical axis of the symbol image based on the start code pattern and the end code pattern;

calculating a scan line angle between a scan line and the horizontal axis of the stored image;

determining a print resolution from the stored image;

locating the plurality of data segment dividers in the stored image;

retrieving a set of control information from the data segments;

restoring the bit-stream of codeword data from the data segments; and

converting the bit-stream of codeword data into original binary data file.

17. The method as recited in claim 16, wherein the restoring of the bit-stream of codeword data comprises applying an error correction operation on the bit-stream of codeword data.

18. The method as recited in claim 17, wherein the restoring of the bit-stream of codeword data further comprises performing masking operations on the bit-stream of codeword data using a predefined mask based on the control information if required.

19. The method as recited in claim 18, further comprising: calculating all coordinates for the plurality of data elements between the left border and the right border starting from a first segment divider, and determining the plurality of codeword information using the coordinates of the data elements.

20. The method as recited in claim 18, wherein the scanning of the 2D symbol is performed by a scanner including a software module configured to determine an orientation of the 2D symbol and a memory space for the stored image.

21. The method as recited in claim 20, wherein the stored image is first processed by the software module in accordance with the left border and the right border so that the bit-stream of codeword data can be determined.

22. A method for decoding a 2D symbol including a plurality of bars and spaces in a data area representing a bit-stream of codeword data from a binary data file, the data area circumscribed by a top border, a bottom border, a left border and a right border, a plurality of data segment dividers dividing the bit-stream data area into a plurality of data segments, the method comprising:

scanning the 2D symbol to produce a first scan line in a scanned image;

searching in the scanned image for the top border having a start code pattern, and the bottom border having an end code pattern;

switching to a decoding method to scan the 2D symbol in entirety before decoding when the scanned image is determined upside down or is an mirror image;

(a) scanning the 2D symbol into a scanned image until a first data segment is detected;

(b) retrieving a set of control information codewords for the first data segment after error correction;

(c) switching to the decoding method for the graphic symbol image in entirety if the first data segment is out of sequence, or the bit-stream data area in the first data segment is stored in an interleaved order;

(d) retrieving the plurality of codeword information in the bit-stream data area using the coordinates of the data elements in the current data segment;

(e) restoring a first part of the first bit-stream of codeword data for the current data segment;

repeating steps (a) through (e) for every data segment divider is detected till the bottom border is detected.

23. The method as recited in claim 22, wherein an element of the codeword data includes a matrix of three columns by three rows of spaces or bars.

24. The method as recited in claim 23, wherein the 2D symbol is expandable in accordance with the binary data file.

25. The method as recited in claim 22, wherein the control information comprises:

total number of the data segments;

an interleaf toggle;

an pre-selected error correction level;

a predefined mask type; and

a data segment number.

26. A 2D symbol embedding information readable by a scanning device to recover the information, the 2D symbol comprises:

a data information area;

a top border and a bottom border, a left border and a right border circumscribing the data information area, both of the top border and the bottom border being directional by embedding start and stop patterns, wherein the data information area includes at least a data segment generated from a bit-stream including binary data and error correction codewords; and

wherein, when the bit-stream exceeds a certain line to require two or more data segments, a data segment divider is provided to separate two adjoining data segment.

27. The 2D symbol as recited in claim 26, wherein the top border includes at least one start code pattern and one terminator code pattern, and the bottom border includes at least one end code pattern and one terminator code pattern to facilitate detection of an orientation of the 2D symbol.

28. The 2D symbol as recited in claim 27, wherein the start code pattern of the top boarder and the end code pattern of the bottom border includes eight alternated bars and spaces, the start code pattern has width ratio of 3:2:1:1:1:2:2:3 modules and the end code pattern has width ratio of 3:1:2:3:2:2:1:1 modules.

29. The 2D symbol as recited in claim 27, wherein the left border and the right border are a pair of identical positioning blocks including alternating bars and spaces according to a predefined pattern.